[0088] In the reference data acquisition operation 1002, ECG data (original data) of a group of arrhythmia patients is acquired. The ECG data may be collected by ECG sensors attached to patients who have been diagnosed with arrhythmia. In general, ECG sensors perform collecting ECG data sensed at certain time intervals, for example, 30 Hz or 60 Hz, and thus ECG data collected by ECG sensors is time-series data.

[0089] In the preprocessing operation 1004, the acquired ECG data, that is, the original data, is preprocessed. The preprocessed data, which has been processed as an average, a variance, a standard deviation, a sum, a median, a minimum, a maximum, a number of outliers, and/or a value equal to or greater/less than a threshold, per unit time, is produced for a valid section of the original data.

[0090] The analysis model selection operation 1006 is performed before, after, or simultaneously with the preprocessing operation 1004. In this example, a stochastic model specialized to analyze a feature of slow variability over a long time period is selected as an analysis model for conducting a time-series volatility or variability analysis of ECG data. Selection of the analysis model may be automatically made according to a disease or may be made by an input of a user when selection is requested from the user.

[0091] Then, in the diagnosis model generation operation 1008, a time-series variability or volatility analysis is conducted on the values preprocessed in the preprocessing operation 1004 according to the selected analysis model of the analysis model selection operation 1006, and information representing data features, such as a trend, a periodicity, a seasonality, a regularity, an irregularity, and/or a volatility is generated. Then, in operation 1008, features related to the trend, the periodicity, the seasonality, and/or the volatility are extracted, and parameters are calculated based on the extracted features so that a diagnosis model having the calculated parameters is generated. Subsequently, in operation 101, the parameters of the generated diagnosis model learn the original data used in the preprocessing operation 1004, so that a diagnosis model having an optimal feature set is generated.

[0092] According to the disclosed examples, a diagnosis model is generated based on a time-series variability analysis of observational data acquired from a patient, and thus it is possible not only to determine whether the patient has a disease, but also to find a changed condition, such as occurrence of a disease, reoccurrence of a disease, and recovery from a disease. Furthermore, it is possible to provide a diagnosis model that enables estimation of a risk of disease occurrence in the future.

[0093] The preprocessor 14, the time-series analyzer 16 and the model generator 18 in FIG. 1, the preprocessor 42, the time-series analyzer 43, the first model generator 44 and the training processor 45 in FIGS. 4 to 6, the analysis model selector 54 in FIG. 5, and the second time-series analyzer 62 and the second model generator 64 in FIG. 6 that perform the operations described in this application are implemented by hardware components configured to perform the operations described in this application that are performed by the hardware components. Examples of hardware components that may be used to perform the operations described in this application where appropriate include controllers, sensors, generators, drivers, memories, comparators, arithmetic logic units, adders, subtractors, multipliers, dividers, integrators, and any other electronic components configured to perform the operations described in this application. In other examples, one or more of the hardware components that perform the operations described in this application are implemented by computing hardware, for example, by one or more processors or computers. A processor or computer may be implemented by one or more processing elements, such as an array of logic gates, a controller and an arithmetic logic unit, a digital signal processor, a microcomputer, a programmable logic controller, a field-programmable gate array, a programmable logic array, a microprocessor, or any other device or combination of devices that is configured to respond to and execute instructions in a defined manner to achieve a desired result. In one example, a processor or computer includes, or is connected to, one or more memories storing instructions or software that are executed by the processor or computer. Hardware components implemented by a processor or computer may execute instructions or software, such as an operating system (OS) and one or more software applications that run on the OS, to perform the operations described in this application. The hardware components may also access, manipulate, process, create, and store data in response to execution of the instructions or software. For simplicity, the singular term "processor" or "computer" may be used in the description of the examples described in this application, but in other examples multiple processors or computers may be used, or a processor or computer may include multiple processing elements, or multiple types of processing elements, or both. For example, a single hardware component or two or more hardware components may be implemented by a single processor, or two or more processors, or a processor and a controller. One or more hardware components may be implemented by one or more processors, or a processor and a controller, and one or more other hardware components may be implemented by one or more other processors, or another processor and another controller. One or more processors, or a processor and a controller, may implement a single hardware component, or two or more hardware components. A hardware component may have any one or more of different processing configurations, examples of which include a single processor, independent processors, parallel processors, single-instruction single-data (SISD) multiprocessing, single-instruction multiple-data (SIMD) multiprocessing, multiple-instruction single-data (MISD) multiprocessing, and multiple-instruction multiple-data (MIMD) multiprocessing.

[0094] The methods illustrated in FIGS. FIGS. 7 to 10 that perform the operations described in this application are performed by computing hardware, for example, by one or more processors or computers, implemented as described above executing instructions or software to perform the operations described in this application that are performed by the methods. For example, a single operation or two or more operations may be performed by a single processor, or two or more processors, or a processor and a controller. One or more operations may be performed by one or more processors, or a processor and a controller, and one or more other operations may be performed by one or more other processors, or another processor and another controller. One or more processors, or a processor and a controller, may perform a single operation, or two or more operations.

[0095] Instructions or software to control computing hardware, for example, one or more processors or computers, to implement the hardware components and perform the meth-